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 [21] Appl. No. **829,606**
 [22] Filed **June 2, 1969**
 [45] Patented **June 29, 1971**
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[56]

References Cited

UNITED STATES PATENTS

3,498,712 3/1970 Kolibas et al. 355/66 X

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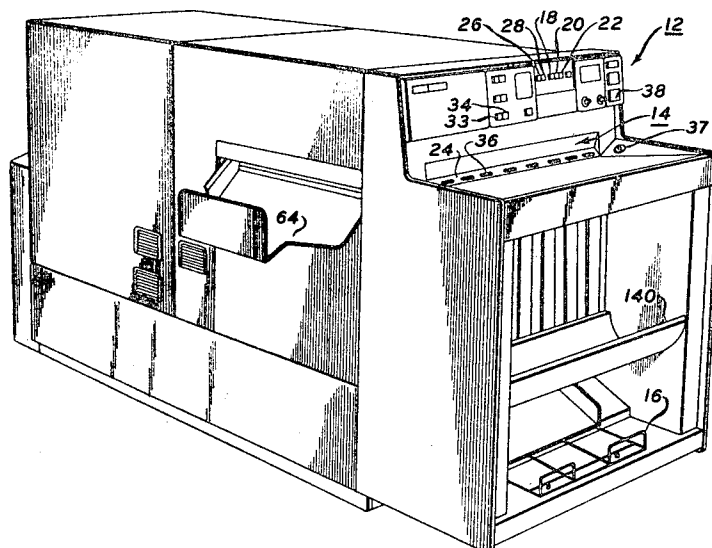
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[54] **REPRODUCING APPARATUS**
6 Claims, 5 Drawing Figs.

[52] U.S. Cl. 355/3,
 355/8, 355/66, 355/72
 [51] Int. Cl. G03g 15/00
 [50] Field of Search 355/3, 8,
 64—66, 72

ABSTRACT: A continuous and automatic xerographic reproducing machine operable in any of several modes. The machine is adapted to create copy on sheet material of either of two sizes. A sheet-conveying assembly then selectively directs the copy through the machine to an enlarged catch tray at a first output end remote from the sheet input end. In the alternative, the sheet material may be conveyed along an alternate path to a smaller catch tray at a second output end on a side of the machine remote from the first output end and the sheet input end.



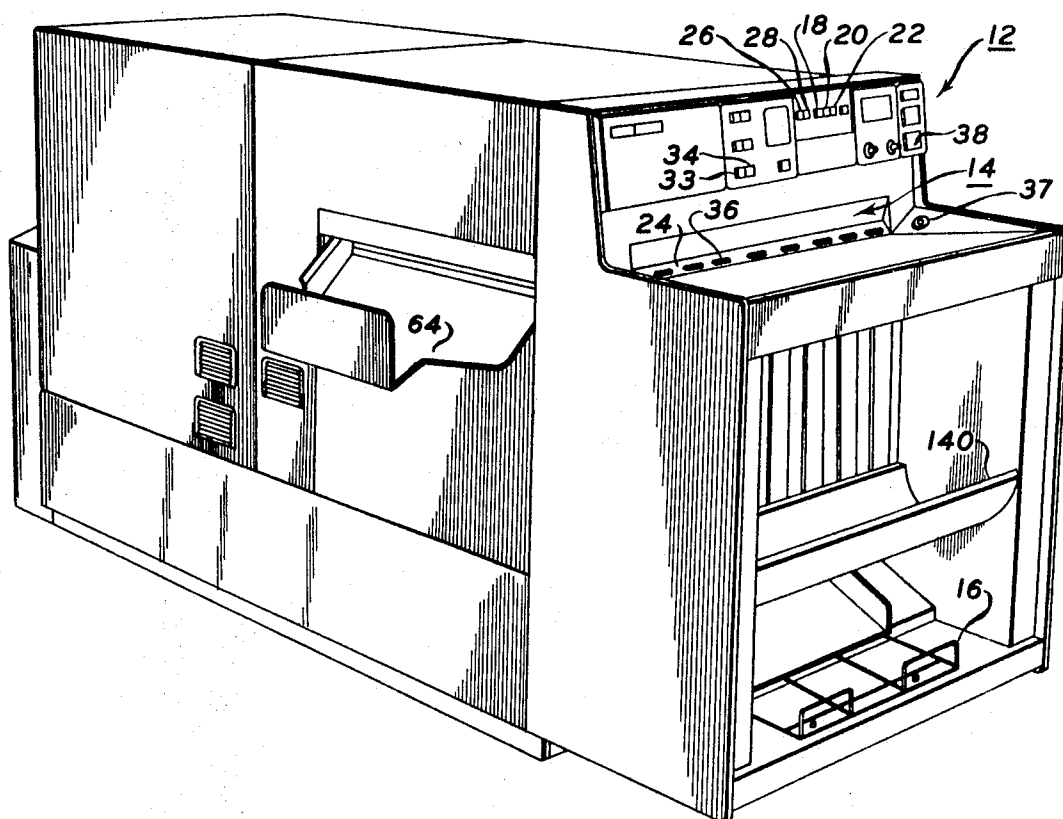


FIG. 1

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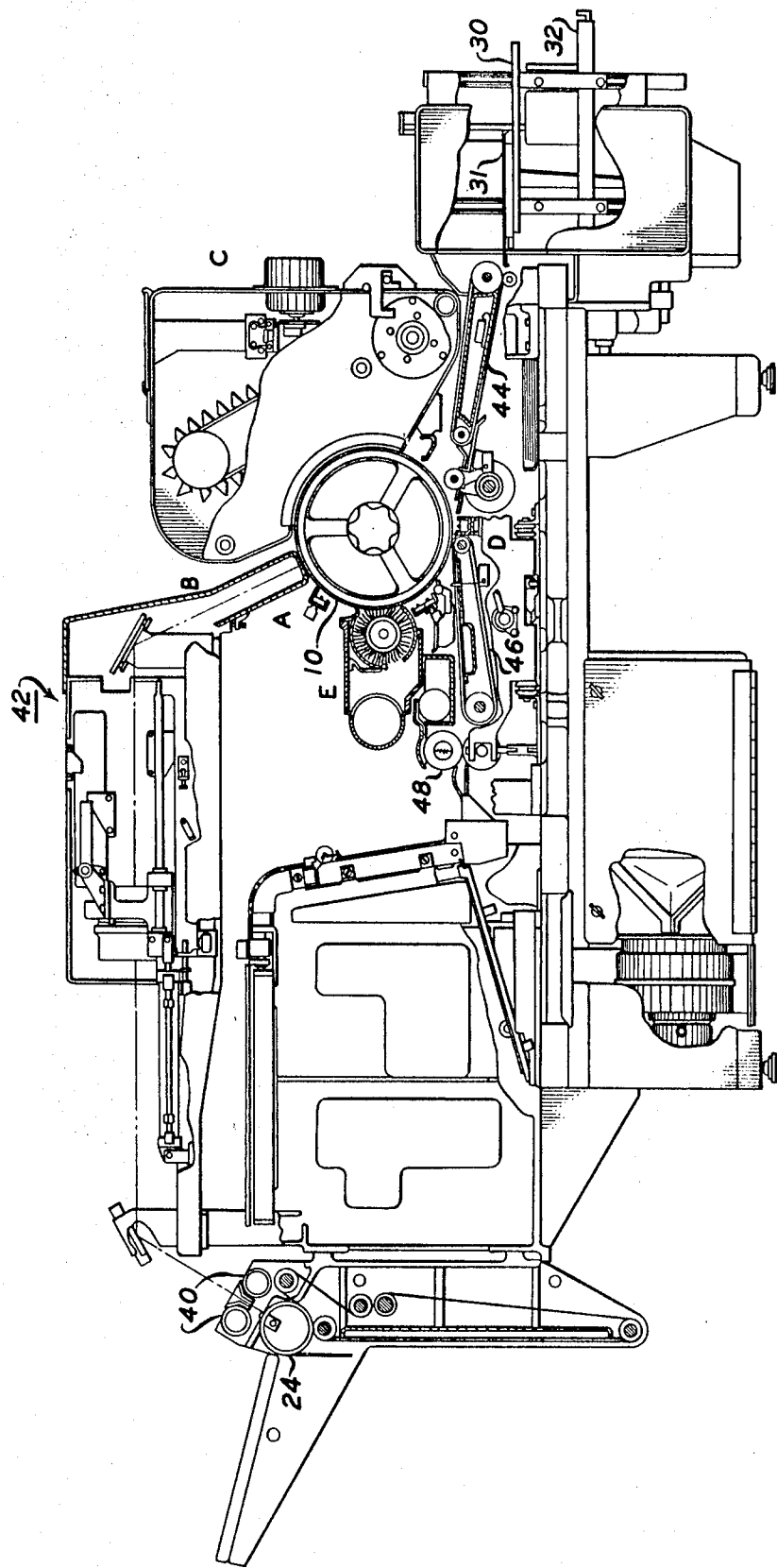


FIG. 2

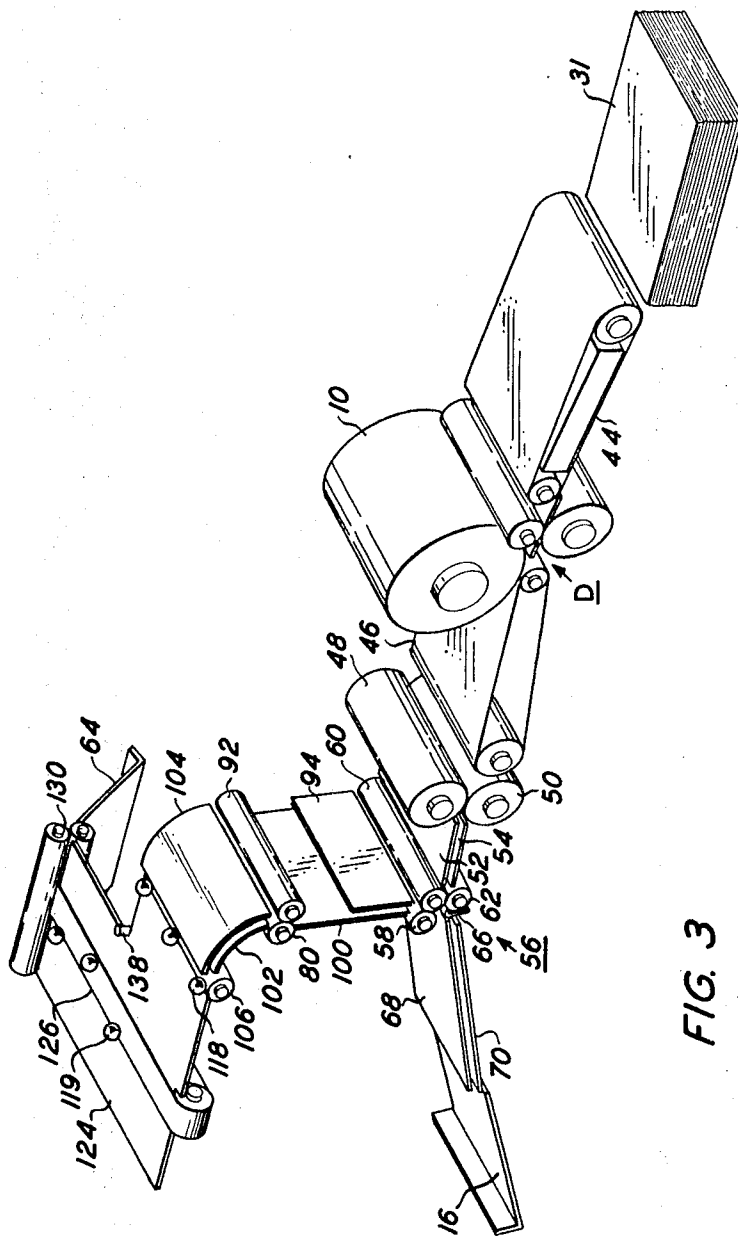


FIG. 3

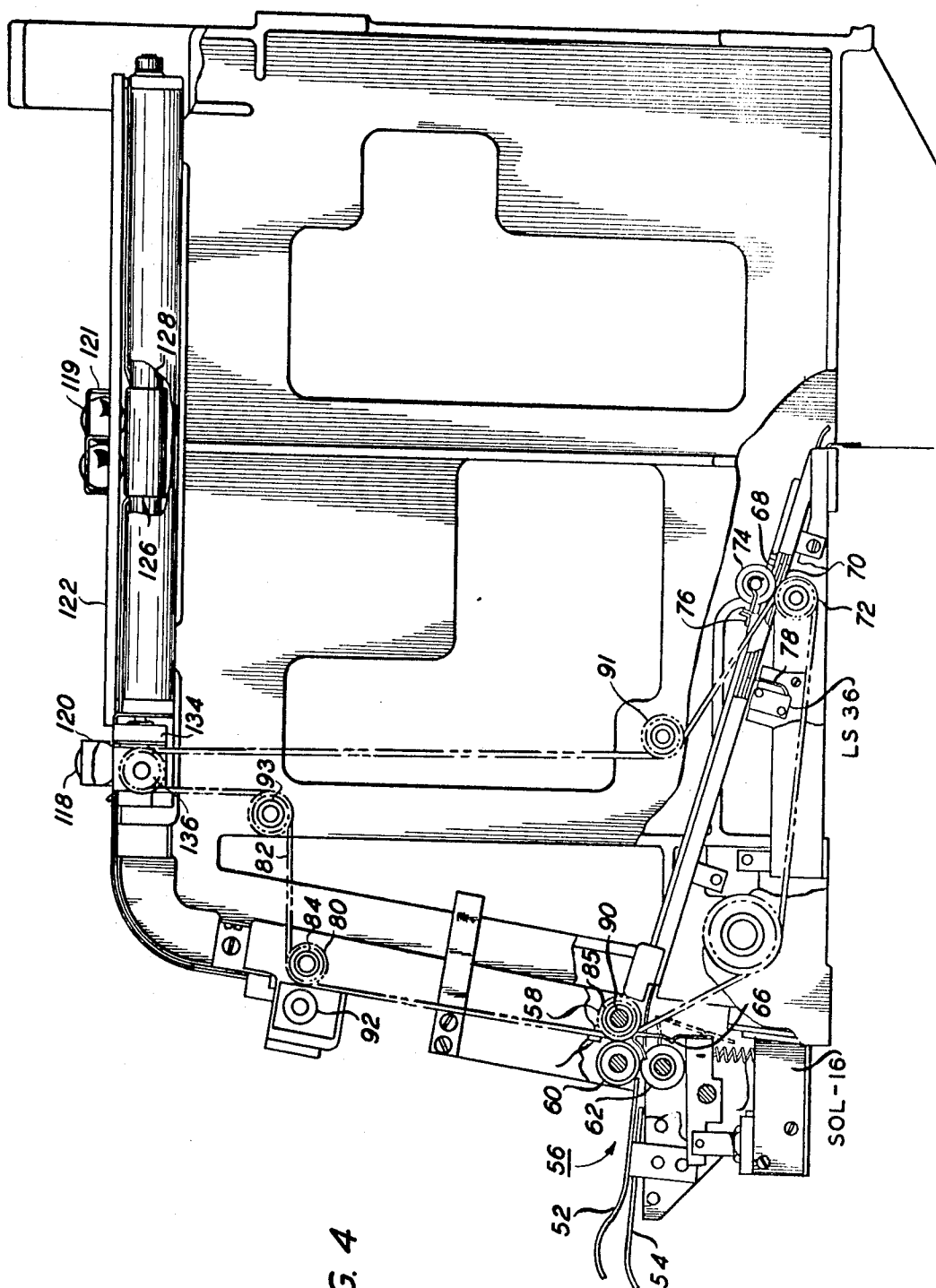


FIG. 4

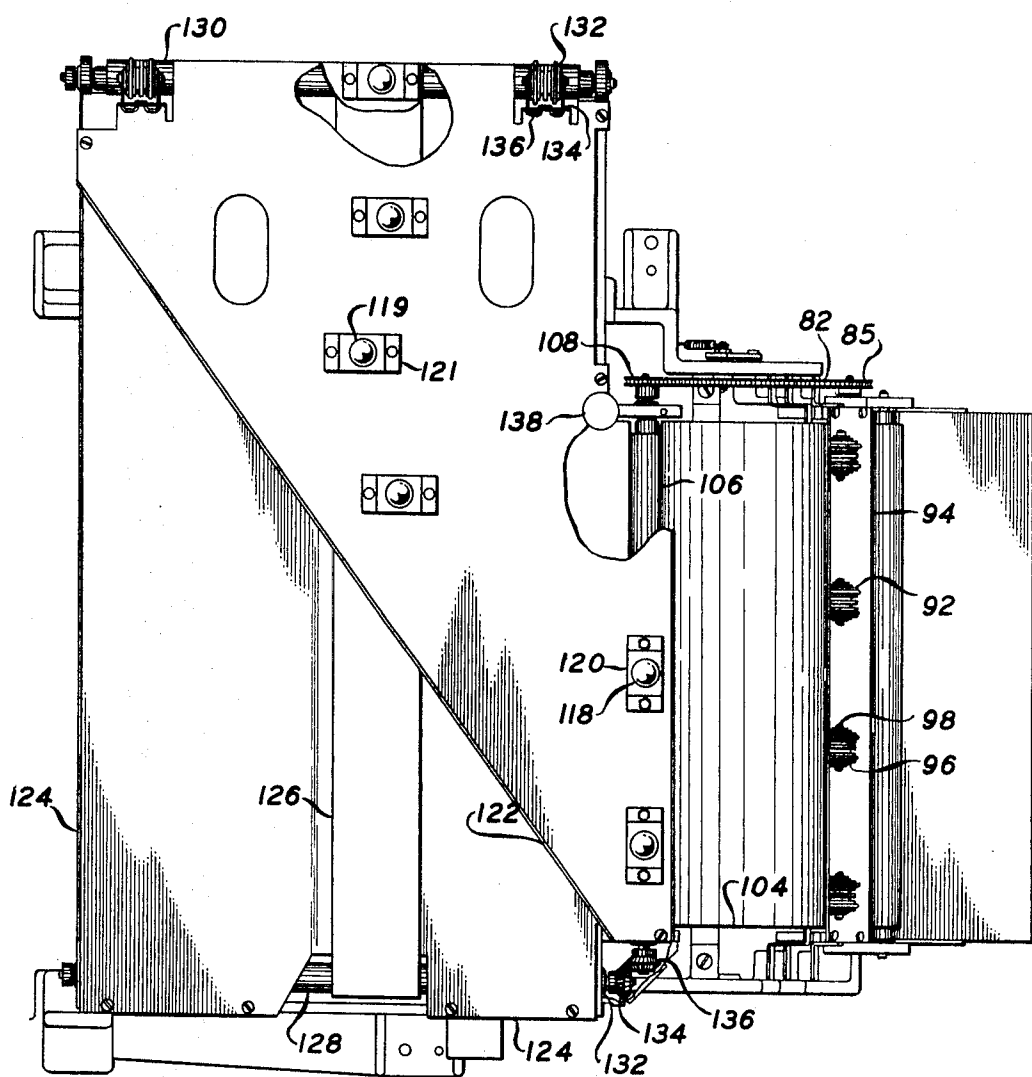


FIG. 5

REPRODUCING APPARATUS

This invention relates to a sheet-conveying assembly and more particularly to apparatus for transporting copy sheets through a reproducing machine.

In the process of xerography, as described in U.S. Pat. No. 2,297,691 to Chester F. Carlson, a xerographic surface comprising a layer of photoconductive insulating material affixed to a conductive backing is used to support electrostatic images. In the usual method of carrying out the process, the xerographic surface is electrostatically charged uniformly over its surface and then exposed to a light pattern of the image being reproduced to thereby discharge the charge in the areas where light strikes the layer. The undischarged areas of the layer thus form an electrostatic charge pattern in conformity with the configuration of the original light pattern.

The latent electrostatic image can be then developed by contacting it with a finely divided electrostatically attractable material such as powder. The powder is held in image areas by the electrostatic charges on the layer. Where the charge field is greatest, the greatest amount of material is deposited; where the charge field is least, little or no material is deposited. Thus a powder image is produced in conformity with the light image of copy being reproduced. The powder is subsequently transferred to a sheet of paper or other surface and suitably affixed thereto to form a permanent print.

Most xerographic equipment in commercial use today is adapted to make reproductions on sheet material retained in a stack within the equipment. This sheet material, once it has received the permanent image thereon, is fed to an output station or copy catch tray communicating with exterior of the machine.

When it is desired to reproduce the original onto a sheet of a different size, it is generally necessary to manually remove the original stack of sheet material and replace it with a stack of sheet material of the desired size. But with the capacity of a reproducing machine to make copies on sheet material of varying size, it has been found desirable to feed the created copy to one of a plurality of copy catch trays of different sizes and at different sides of the machine.

By way of example, most xerographic reproducing machines discharge the copy to a catch tray dimensioned to receive 8½ inches × 11 inches letter size sheets or 8½ inches × 13 inches legal size sheets. Engineering drawing size sheets, 11 inches × 17 inches, cannot be received by most copy catch trays. One solution to the problem of handling the larger sheets in a machine operable with the smaller sheets is to fold the larger sheets prior to delivery to the conventionally sized catch tray. Another solution is to provide a second and enlarged copy catch tray. This permits the enlarged copy to be discharged from the reproducing machine in an unfolded state which, in many applications is highly desirable. These results may be facilitated through a copy-sheet-conveying assembly within the reproducing machine to selectively convey the copy to the diverse catch trays.

The incorporation of copy catch trays at remote locations and at different sides of the machine also permits the permanent attachment of a sheet distributor at one of the output stations without interfering with the normal functioning of the copy catch tray at the other output station. With this arrangement, the attached sheet distributor need not be disconnected from the reproducing machine when its use is not desired.

The present invention is directed to sheet-feeding apparatus in a reproducing machine whereby sheet material from either of two support stations may be fed through the machine along either of two feed paths to either of two copy catch trays. The sheet material may be diverted from the primary sheet feed path along a secondary sheet feed path and then turned to move in a direction normal therefrom for being discharged to a secondary copy catch tray at an output station on a side of a reproducing machine remote from both the primary output station and the sheet input station. The sheet material may

also be directed to the secondary catch tray in a folded or unfolded orientation by the use of a sheet folder assembly incorporated therewith.

It is therefore an object of the instant invention to convey sheet material in a reproducing machine.

It is a further object of the instant invention to feed sheet material from a preselected stack of sheet material.

It is a further object of the instant invention to selectively direct copies to a first output station or a second output station, the second output station being on the side of the machine remote from the first output station.

It is a further object of the instant invention to automatically direct sheet material along the first sheet feed path to a first catch tray or to a second catch tray by a second sheet feed path.

These and other objects of the instant invention are attained in accordance with the present invention by sheet-conveying apparatus in a continuous and automatic reproducing machine. The conveying assembly is adapted to feed either of two sizes of sheet material for forming copy thereon. The copy may then be directed through the machine to a first output station remote from the sheet input station. In the alternative, the sheet material may be fed on an alternate path to a second output station on a side of the machine which is remote from the first output station as well as the sheet input station. The sheet material may be delivered to the second sheet feed station in a folded or unfolded state.

Further objects of this invention together with additional features and advantages thereof will become apparent from the following description of one embodiment of the invention when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a continuous and automatic reproducing machine employing the sheet-feeding assembly of the instant invention;

FIG. 2 is a schematic representation of the xerographic reproducing machine as shown in FIG. 1;

FIG. 3 is a perspective view of the sheet-feeding assembly shown in FIG. 2, with parts broken away for clarity;

FIG. 4 is an enlarged side elevation of a portion of the sheet-feeding assembly as seen from the inboard side of the machine including the sheet feeding and turning station; and

FIG. 5 is a plan view of a portion of the sheet-feeding assembly showing a part of the second sheet feed path.

Referring now to the drawings, there is shown schematically in FIG. 2 an embodiment of the subject invention in a suitable environment such as an automatic xerographic reproducing machine. The automatic xerographic reproducing machine includes a xerographic plate or surface 10 formed in the shape of a drum. The plate has a photoconductive layer or light receiving surface on a conductive backing, journaled in a frame to rotate in the direction indicated by the arrow. The rotation will cause the plate to sequentially pass a series of xerographic processing stations. For the purpose of the present disclosure, the several xerographic processing stations in the path of movement of the plate surface may be described functionally as follows:

A charging station A, at which a uniform electrostatic charge is deposited on the photoconductive plate;

An exposure station B, at which a light or radiation pattern of copy to be reproduced is projected onto the plate surface to dissipate the charge in the exposed areas thereof to thereby form a latent electrostatic image of the copy to be reproduced;

A developing station C at which xerographic developing material, including toner particles having an electrostatic charge opposite that of the latent electrostatic image, is cascaded over the plate surface whereby the toner particles adhere to the latent electrostatic image to form a toner image in a configuration of the copy being reproduced;

A transfer station D at which the toner image is electrostatically transferred from the plate surface to a transfer material or a support surface; and

A drum cleaning and discharge station E at which the plate surface is brushed to remove residual toner particles remaining thereon after image transfer and exposed to a relatively bright light source to effect substantially complete discharge of any residual electrostatic charge remaining thereon.

It is felt that the preceding description of the xerographic process is sufficient for an understanding of the instant invention. Further details of the xerographic apparatus may be had by reference to U.S. Pat. No. 3,301,126 issued to Osborne et al.

In addition to the apparatus disclosed in the aforementioned Osborne et al. patent, the xerographic machine is also provided with supplemental mechanisms to increase the overall utility of the machine. The operator's basic position in operating the machine disclosed herein is facing the control panel 12, document conveyor assembly 14 and first copy catch tray 16. An array of operational control buttons and dials face the operator and include buttons 18, 20, and 22 for controlling the lens location of optical reduction in association with the speed of rotation of the document supporting drum 24. Also on the control panel are the A and B buttons 26 and 28 whereby trays 30 and 32 supporting stacks 31 of sheet material of different sizes may be positioned to feed sheet material through the machine for receiving the xerographic copy. Furthermore, a "FOLDER OFF" button 33 and a "FOLDER ON" button 34 are provided whereby sheet material of a larger size may be folded prior to its movement to exterior of the machine.

In using the machine, the operator places the leading edge of the document to be reproduced beneath the gripper fingers 36 of the document drum. Depression of "GRIPPERS" button 37 will cause the grasping of the document while the depression of the button 38 will then convey the original document past the illumination means 40 to flowingly project an image, by the optical assembly 42, onto the rotating xerographic drum. An electrostatic image will then be created so that a toner image may be electrostatically adhered thereto for being transferred to the copy sheet being fed through the machine. The sheet material forwarded by the sheet support tray will be advanced a first or A transport 44 past the electrostatic transfer station D and then to a second or B transport 46 whereafter it will be conveyed and fused by the driven heated pressure rollers 48 and 50. Beyond this, the direction of movement of the sheet material, now containing the permanent toner image, will be directed by baffle plates 52 and 54 to direct the leading edge of the sheet material to the sheet folding and turning station 56.

The xerographic drum and the two belt transports, in addition to the heated pressure-fusing rollers are all driven off of a main drive motor, not shown, the power being distributed by a main serpentine drive chain as disclosed in the aforementioned Osborne et al. patent. Also positively driven off the main drive and serpentine chain is roller 58 within the sheet folding and turning assembly. This driven roller 48 is in rolling frictional contact with idler roller 60, which, in turn, is in frictional rolling contact with roller 62 whereby driving impetus is given to sheet material in association therewith.

The portion of the sheet feed path between the support trays and the fold and turn station is common regardless of whether it is desired to feed the sheet material to the first and larger copy catch tray 16 at the first sheet output station or the second and smaller copy catch tray 64 at the second sheet output station.

If it is desired to feed larger sheet material from the larger or B tray 32 in the straight line path through the machine to the first copy catch tray, solenoid SOL-16 is deenergized by the activation of the "FOLDER OFF" button to withdraw the interference member 66 to the withdrawn or dotted line position as shown in FIG. 4. In this manner, sheet material will be conveyed by rollers 60 and 62 between guide baffles 68 and 70 to the first copy catch tray 16. Driven rollers 72 and idler rollers 74, held to the upper baffle 68 by spring clips 76 assist in the moving and guiding of the sheet material. With the solenoid

SOL-16 deenergized to hold the interference member 66 in the withdrawn position, limit switch LS-36 will be inactivated by suitable circuitry. LS-36 has a purpose to be described later with respect to the second sheet feed path. In this manner, the depression of the "FOLDER OFF" button 34 will permit sheet material to be fed from sheet support tray 32 at the first end of the machine through the transfer station D past the sheet folding and turning station 56 to the first copy catch tray 16 along the first sheet feed path. Further details of the programmed operation of the sheet folding and turning station can be had with reference to pending application Ser. No. 829,365 filed concurrently herewith in the name of George D. DelVecchio et al.

Whenever sheet material is to be fed from the upper sheet support tray 30 containing the smaller sheet material, solenoid SOL-16 will be energized through the depression of the A button 26 to retain the interference member 66 in the interference or solid line position of FIG. 4 to direct all sheet material upwardly along the second sheet feed path. This orientation is true independent of the state of either of the folder buttons 33, 34. If sheet material is to be fed from the lower or second sheet support tray 32 containing the larger sized sheet material, depression of the "FOLDER ON" button 33 will permit SOL-16 to be deenergized to hold the interference member 66 in the withdrawn position. SOL-16, however, will be momentarily actuated as the leading edge of the sheet material contacts the actuator arm 78 of limit switch LS-36 to trip the solenoid, and drive the interference member 66 and an intermediate section of the sheet material upwardly to advance the folded central section of the sheet material through rollers 58 and 60 along the second sheet feed path. Arm 78 is so located that contact by a sheet occurs while half of the sheet is in advance and half of the sheet is beyond interference member 66. As previously described herein, the depression of the "FOLDER OFF" button 34 inactivates the relationship between limit switch LS-36 and solenoid SOL-16 so that the leading edge of sheet material will not cause the pulsing of solenoid SOL-16 and thereby permits the sheet material to be moved along the first sheet feed path. The operative coupling of solenoid SOL-16 and limit switch LS-36 with the A and B buttons 26 and 28 as well as the "FOLDER ON" and "FOLDER OFF" buttons 33 and 34 is attainable by any suitable means. One such means is disclosed in the aforementioned application Ser. No. 829,365.

Sheet material moved upwardly along the second sheet feed path, whether it is a folded center section of the larger sheet material or an unfolded smaller sheet, will be moved by driven roller 58 in association with idler roller 60 in frictional contact therewith. Roller 58 and roller 80 are driven at a common linear speed through chain 82 interconnecting sprockets 84 and 85 on the shafts 88 and 90 which support these rollers. Supported gears 91 and 93 assist in guiding the movement of chain 82. In driving frictional association with driven roller 80 are idler rollers 92 in contact with the face of roller 80. These idler rollers are mounted through apertures in baffle plate 94 and are held in position by spring clips 96 mounting the shafts 98 which support these idler rollers. Baffle plate 100 cooperates with baffle plate 94 in directing fed sheets upwardly.

The driving force imparted to the sheet material being transported is provided by rollers 80 and 92 which drive the sheet material upwardly through curved guide plates 102 and 104 until the leading edge of the sheet material comes into contact with roller 106, also driven off of chain 82 through sprocket 108. As sheet material is passed above driven roller 106 its upper surface is held in contact with the driving roller by ball members 118 having their upper portions extending through a circular aperture in small support plates 120 mounted on the upper of baffle 122. The lower portion of the balls extend through baffle 122 to provide rolling contact with the sheet material across lower support plate 124.

The movement of the leading edge of the sheet material beyond driven roller 106 rings the sheet material into a right-

angle turn area whereby it may be directed toward another side of the machine toward the second copy catch tray 64. At the right-angle turn station is the lower support plate 124 over which the fed sheet material may slide. In association with the support plate is a drivebelt 126 extending at right angles to the initial direction of travel of the sheet material being forwarded. This drivebelt is mounted for rotation on rollers 128 and 130 near the opposite ends of the slide plate 124. Roller 128 is mounted on drive shaft 132 having beveled gear member 134 in meshing relationship with beveled gear member 136 on the same shaft which supports drive roller 106. In this manner the linear speed of drive roller 106 and drivebelt 126 may be uniform. The drivebelt 126 is mounted with its lower reach beneath the rollers 128 and 130 and support plate 124 but with its upper reach slideable above the support plate 124. Rotatable ball members 119 in support brackets 121, similar to those positioned in cooperation with drive roller 106, are located through upper baffle 122 to assist belt 126 in holding sheet material in contact therewith as they are moved toward the second copy catch tray 64.

Also mounted on the baffle plate 122 to assist in the forwarding of the sheet material to the second copy catch tray 64 are idler rollers 132 mounted on upturned flanges 134 of the guide plate 122 through spring clips 136. These idler rollers 132 are in rolling contact with roller 130 to achieve a more positive feeding of the sheet material toward the second copy catch tray 64.

As sheet material moves through the machine, is directed upwardly along the second sheet feed path through the guide plates 94 and 100. This sheet material then is directed to a substantially horizontal position through curve guide plates 102 and 104. Further movement of the sheet material past drive roller 106 will bring the leading edge of the sheet material into contact with drivebelt 126 which is being driven perpendicularly with respect to the initial direction of the fed sheet material. The interaction of driven roller 106 and driven belt 126 on the fed sheet material is such as to cause the leading edge of the sheet material to turn 90°, its side being pivoted about fixed turning post 138 extending vertically from slide plate 124. Resultantly, the leading edge of the paper moving across drive roller 106 continues to be the leading edge as it moves in a perpendicular direction along drivebelt 126. Further movement of the sheet material by the drivebelt 126 directs the sheet material to be forwarded into the second copy catch tray 64.

As can be seen, the copy catch trays 16 and 64 are located at separate sides of the machine but both are readily accessible to an operator standing at the document conveyor assembly 14. As a further convenience the operator, a document catch tray 140 is also located adjacent the operator's work station. After single or multiple imaging of the document, the original is fed to the document catch tray 140 in a manner as more specifically described in copending application Ser. No. 829,608 filed concurrently herewith in the names of George D. DelVecchio et al.

While the second copy catch tray is shown as an integral part of the reproducing machine, the copy catch tray could readily be removed and replaced with a sorter module of the type, for example as disclosed in pending application Ser. No. 547,990 filed Aug. 25, 1966 in the names of James E. Britt, et al.

While the instant invention as to its objects and advantages has been described as carried out in a specific embodiment thereof, it is not intended to be limited thereby but to be covered broadly within the scope of the appended claims.

What I claim is:

1. A sheet conveying assembly for a reproducing machine including
 - support means on a first side of the conveying assembly to retain sheet material to be fed through the apparatus,
 - image-forming means to create a reproduction on the sheet material fed through the assembly,
 - a first sheet output station communicating with exterior of the apparatus on the side of the apparatus opposite the sheet support means,
 - a second sheet output station communicating with exterior of the apparatus on the side of the apparatus remote from said first sheet output station and said sheet support means,
 - a first sheet feed path along which sheet material moves from said first support means through the apparatus past the image-forming means to said first sheet output station,
 - a second sheet feed path along which sheet material moves from the support means through the apparatus to said second sheet output station, said first and second sheet feed paths having a common extent from said sheet feed means to beyond said image-forming means, and
 - means to selectively direct sheet material along said first or second sheet feed path.
2. The apparatus as set forth in claim 1 wherein sheet support means includes a first tray for the retention of sheet material of a first characteristic and a second support tray for the retention of sheet material of a second characteristic and further including means to selectively position said first or second sheet support means to permit the feeding of sheet material therefrom.
3. The apparatus as set forth in claim 1 and further including a document-handling station on the side of the apparatus with said first sheet output station, said document-handling apparatus including means to receive and move the document past an exposure station and also including a document catch tray for receiving the document after its exposure.
4. The apparatus as set forth in claim 4 wherein said second sheet feed path includes an upwardly directed portion followed by a horizontally disposed portion and means to turn the documents 90° while at said horizontal portion to feed the turned document to said second sheet output station.
5. Xerographic reproducing apparatus including
 - copy sheet support trays adapted to retain a plurality of stacks of sheet material of diverse characteristics adjacent one side of the apparatus,
 - a first sheet feed path to move sheet material from one of said support trays past an image-forming means to a juncture area,
 - means to move a preselected tray into operative proximity to input end of said first sheet feed path for the moving of sheet material therealong,
 - a second sheet feed path extending from said juncture area to a primary copy catch tray on a side of the apparatus opposite said sheet support station,
 - a third sheet feed path extending from said juncture,
 - means to turn sheet material fed along said sheet feed path toward a side of the apparatus remote from said first and second mentioned sides and
 - a supplemental catch tray at the output end of said third sheet feed path for the reception of sheet material fed along said third sheet feed path.
6. The apparatus as set forth in claim 5 and further including a selectively operable sheet directing member adjacent said juncture area to direct sheet material along said second or third sheet feed path.